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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/695,609	10/28/2003	Eiichi Iino	81839.0142	6295

26021 7590 05/02/2005

HOGAN & HARTSON L.L.P.
500 S. GRAND AVENUE
SUITE 1900
LOS ANGELES, CA 90071-2611

EXAMINER	
ANDERSON, MATTHEW A	
ART UNIT	**PAPER NUMBER**
1722	

DATE MAILED: 05/02/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/695,609	IINO ET AL.	
	Examiner	Art Unit	
	Matthew A. Anderson	1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *28 October 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *10-13* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *10-13* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *28 October 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☒ Certified copies of the priority documents have been received in Application No. 09/287,199.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *10/28/2003*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. The preliminary amendment filed on 10/28/2003 is noted.

Specification

2. The abstract of the disclosure is objected to because the abstract is limited to one paragraph. Correction is required. See MPEP § 608.01(b).

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

4. Claim 11 is rejected under 35 U.S.C. 102(b) as being anticipated by Murai et al. (US 5,501,172).

Murai et al. discloses a method of growing silicon single crystals by the Cz (Czochralski) method of pulling. (abstract) In Fig. 1 is shown a tapered single

crystalline silicon seed crystal used in the Cz method (col. 5 and 6, lines 55+ and 1-13, respectively). The tapered seed length is denoted 'X' and the length of the neck is denoted 'Y'. The tapered seed is seen to not have a straight body in Fig. 1. The seed is lowered into the molten raw material and then raised from the melt to pull the single crystalline ingot (7). The neck is disclosed in col. 1 lines 1-25 as needed to remove dislocations from the ingot. In col. 4 lines 5-15 it is disclosed that the seed is kept in the melt until thermal equilibrium between it and the melt is achieved. This suggests that the seed reaches at least the melting temperature of Si in the tip end immersed in the melt. Then the typical necking operation is performed. It is noted that the narrow neck is cause for concern when pulling very large ingots which may cause the neck to mechanically fail.

5. Claim 13 is rejected under 35 U.S.C. 102(e) as being anticipated by Abe et al. (US 5,911,822).

Abe et al. describes in claim 1 a Cz method of forming a Si single crystal in which a Si seed is brought into contact with molten raw material to melt the tip end of the seed and pulling up the seed to grow the Si single crystal without performing the necking operation. The seed is claimed as having a sharp pointed shape or a truncation of such a shape. The examiner notes that such a shape does not have a straight body. (see Figs. 2A-2D). In col. 2 lines 50+, Abe et al. stresses the need for a strong seed crystal during pulling.

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

8. Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Murai et al. as applied to claim 11 above, and further in view of Wolf et al. (Silicon Processing in the VLSI Era, Volume 1: Process Technology, Lattice Press, Sunset Beach, CA, USA, pp. 59-61, 1986.).

Murai et al. is described above.

Murai et al. does not disclose the material property of oxygen content of the seed crystal.

Wolf et al. is a textbook disclosing processing and material parameters typical in Si. The typical oxygen concentration is found on page 59 to be from 10-20 ppma. On page 61, in the paragraph immediately before the Gettering header, is disclosed the beneficial strengthening effect of oxygen. The most beneficial were small oxygen clusters of about ~500 angstrom size which were achieved with oxygen precipitation. The process parameters temperature and concentration are suggested to determine the precipitate size obtained during processing.

It would have been obvious to one of ordinary skill in the art at the time of the present invention to combine Murai et al. and Wolf et al. because Wolf et al. describes ways of strengthening Si and Murai et al. suggests the need for stronger Si at the narrow neck formed from the seed during Cz pulling. (Motivation is increased safety and production.)

In respect to claims 10, it would have been obvious to one of ordinary skill in the art at the time of the present invention to produce a silicon single crystal by the Cz method comprising bringing a tip end of a seed crystal into contact with a Si melt, melting the tip end of the seed, performing necking operation, and growing (i.e. pulling) a silicon single crystal because such is explicitly disclosed by Murai et al.

Further, it would have been obvious to one of ordinary skill in the art at the time of the present invention to use the Si which was typically available for the seed crystal and to optimize the oxygen content thereof because Wolf et al. suggests this would enhance the strength of the neck, and such optimization of the oxygen content would have been achieved with only routine experimentation.

9. Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Abe et al. as applied to claim 13 above, and further in view of Wolf et al. (Silicon Processing in the VLSI Era, Volume 1: Process Technology, Lattice Press, Sunset Beach, CA, USA, pp. 59-61, 1986.).

Abe is described above.

Abe does not explicitly disclose the material property of oxygen content of the seed crystal.

Wolf et al. is described above.

It would have been obvious to one of ordinary skill in the art at the time of the present invention to combine Abe et al. and Wolf et al. because Wolf et al. describes ways of strengthening Si and Abe et al. suggests the need for stronger Si for use during Cz pulling. (Motivation is increased safety and production.)

In respect to claim 12, it would have been obvious to one of ordinary skill in the art at the time of the present invention to produce a silicon single crystal by the Cz method comprising bringing a tip end of a seed crystal into contact with a Si melt, melting the tip end of the seed, performing necking operation, and growing (i.e. pulling) a silicon single crystal because such is explicitly disclosed by Abe et al.

Further, it would have been obvious to one of ordinary skill in the art at the time of the present invention to use the Si which was typically available for the seed crystal and to optimize the oxygen content thereof because Wolf et al. suggests this would

enhance the strength of the Si in the seed, and such optimization of the oxygen content would have been achieved with only routine experimentation.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew A. Anderson whose telephone number is (571) 272-1459. The examiner can normally be reached on M-F, 8:30-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Benjamin Utech can be reached on (571) 272-1137. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

MAA
April 13, 2005

BENJAMIN L. UTECH
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 1700